

What is claimed is:

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1. A head end apparatus for a cable television operator, comprising:
 one or more inputs for receiving streams of compressed data packets encoding a plurality of programs and/or services;
 one or more transmitters, transceivers or modems, each having an output coupled to a downstream transmission medium and an input for receiving a stream of packets containing data encoding one or more programs and/or services and any other data to be used with said programs and/or services; and
 a pull multiplexer coupled to receive upstream program and/or service requests and to receive said one or more streams of compressed data packets from said one or more inputs, and having one or more data outputs at each of which is output a stream of data packets containing data encoding one or more requested programs and/or services, each said data output being coupled to an input of one of said one or more transmitters, transceivers or modems, said pull multiplexer including a programmed computer to map one or more requested programs and/or services to program identifier codes, IP addresses or other identifying information that can be used by one or more culling switches that are part of said pull multiplexer to cull out data packets from said streams of compressed data packets received at said one or more inputs that contain data encoding said requested program(s) and/or service(s).

2. The apparatus of claim 1 wherein said pull multiplexer further comprises means for variably adjusting the bandwidth of each said output stream of data packets in accordance with commands to conform the bandwidth of said output streams to the availability of bandwidth on the downstream medium.

3. The apparatus of claim 1 wherein said pull multiplexer includes culling switch circuitry to select data packets defining one or more output data streams for transmission on one or more logical channels such that one or more subchannels carry data encoding popular programs and/or services that are to be transmitted downstream regardless of whether there are any current program and/or service requests for said popular programs and/or

6 services and to output said data packets defining said one or more popular programs and/or
7 services at said data output.

1 4. The apparatus of claim 1 wherein said pull multiplexer further comprises means
2 for bandwidth management to insure that said output stream(s) of data packets at said one or
3 more data outputs do not consume more bandwidth than is available on said downstream
4 transmission medium.

1 5. The apparatus of claim 1 wherein said pull multiplexer further comprises means
2 for managing said output streams for maximum efficiency in transmitted requested
3 programs and/or services so that as many requests as possible from as many customers as
4 possible can be fulfilled.

1 6. The apparatus of claim 1 wherein said pull multiplexer further comprises
2 means for assembling data packets that comprise said output streams such that all the data
3 packets that encode requested programs and/or services and associated data to be viewed
4 and/or used at any particular customer premises are transmitted to said customer on a
5 number of logical channels equal to or less than the number of tuners said customer has.

1 7. The apparatus of claim 1 wherein said pull multiplexer further comprises a
2 programmed microprocessor that functions to optimize the assembly of output streams of
3 data packets by analyzing the number of requests for programs and/or services received
4 from each customer and the number of tuners each said customer has and the current
5 availability of subchannels on one or more logical channels and attempts to creates said
6 output streams of data packets so that all the data packets encoding the programs and/or
7 services each particular customer requested are transmitted on subchannels on a number of
8 logical channels that does not exceed the number of tuners said customer has.

1 8. The apparatus of claim 1 wherein said pull multiplexer further comprises a
2 programmed microprocessor that functions to optimize the assembly of output streams of
3 data packets by analyzing the number of requests for programs and/or services received

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20 said output stream received from said multiplexer onto the subchannels designated in
21 one or more said management and control messages received from said multiplexer.

1 10. The apparatus of claim 9 wherein said culling means includes a microprocessor
2 programmed to receive upstream packet data other than requests for programs and/or
3 services and route said upstream packet data to the appropriate wide area network server
4 and/or T-carrier interface circuitry or telephone company digital switch.

1 11. The apparatus of claim 9 further comprising bandwidth compression circuitry
2 coupled to receive said output data streams from said culling means and alter the bandwidth
3 if necessary in accordance with the available bandwidth on a downstream medium to which
4 said head end cherry picker multiplexer is coupled

1 12. The apparatus of claim 9 wherein said culling means includes a programmed
2 microprocessor and stored data indicating how many tuners each customer has to tune into
3 requested or pushed programs and/or services, said microprocessor programmed to analyze
4 the number of requests received from each customer and the number of tuners said customer
5 has and the available bandwidth on a shared downstream medium coupling said head end
6 cherry picker multiplexer to all said customers, and for performing said culling process in
7 such a way as to transmit as many requested programs and/or services as possible to each
8 customer on a number of logical channels that is equal to or less than the number of tuners
9 said customer has to tune said logical channel.

1 13. A head end multiplexer system for a central office of a DSL system, comprising:
2 one or more video inputs for receiving streams of video data from a video
3 server;
4 one or more IP inputs for receiving streams of IP packets from a server,
5 router or gateway coupled to a wide area network;
6 one or more wideband inputs for receiving telephony packets containing
7 digital data from an interface to a wide band digital network such a T-carrier system
8 or X.25 packet network;

9 one or more POTS inputs for receiving plain old telephone service analog
10 signals from a POTS switch in a public service telephone network;

11 one or more upstream inputs for receiving upstream program and/or service
12 requests and upstream data;

13 one or more culling switch means for culling out packets received at said
14 video inputs, said IP inputs and said wideband inputs in accordance with culling
15 selection criteria given to said one or more culling switch means and organizing the
16 resulting culled packets into one or more output streams of packets, each output
17 stream containing the data encoding programs and/or services requested by user(s)
18 at one customer premises;

19 control means for processing upstream program and/or service requests
20 received from users at all customer premises and generating said culling selection
21 criteria for programs and/or services requested from each customer's premises
22 from said upstream program and/or service requests received from that customer's
23 premises, said control means also for generating management and control messages
24 for transmission to each customer premises indicating which logical channel(s) and
25 subchannel(s) on the DSL line coupled to said customer premises on which the
26 requested program(s) and/or service(s) will be found, said control means also for
27 generating management and control messages for controlling which channels and
28 subchannels on which each program and/or service requested by a particular
29 customer will be transmitted on a DSL line coupling said head end multiplexer to said
30 customer premises;

31 one or more DSL modems, each having an output for coupling to a DSL line
32 coupling said head end multiplexer to one customer premises and each having one or
33 more inputs for coupling to receive one of said output data streams from said culling
34 switch means and to receive management and control messages for transmission to
35 the customer premises/said DSL modem is coupled to via a DSL line and to receive
36 management and control messages for use by said DSL modem to control the logical
37 channel(s) and subchannel(s) said DSL modem will use in transmitting data encoding
38 said requested program(s) and/or service(s) to said customer, and each DSL modem
39 having an input for coupling to one of said POTS inputs, and each DSL modem having

40 one or more outputs coupled to said upstream inputs of said control computer, each
 41 DSL modem having circuitry for transmitting data encoding one or more requested
 42 and/or pushed program(s) and/or service(s) on one or more channels of said DSL
 43 line;

44 and wherein said control means includes routing circuitry including a
 45 microprocessor coupled to said upstream inputs for receiving upstream data packets
 46 and programmed to analyze the destination of each upstream data packet and route it
 47 to a WAN gateway or server or T-carrier interface circuitry.

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 1 14. The apparatus of claim 13 wherein said control means includes means for
 2 analyzing the number of tuners each customer has and the number of requests each user has
 3 made and the bandwidth availability on a bidirectional channel and a wideband channel of said
 4 DSL line and for generating said culling selection criteria so that, as many times as possible,
 5 said requested program(s) and/or service(s) are sent on a number of logical channels that
 6 do not exceed the number of tuners said customer has.

1 15. The apparatus of claim 13 wherein said head end cherry picker multiplexer
 2 further comprises bandwidth recoders coupled to receive output data streams from said
 3 culling switch means and functioning to alter the bandwidth of each said output stream in
 4 accordance with instructions, and wherein said control means further comprises means for
 5 analyzing the bandwidth availability on each customer's DSL line and for controlling said
 6 bandwidth recoders accordingly.